CLAIMS:

1. A process for co-producing hydrocarbons and dimethyl ether (DME), the process including

feeding a gaseous feedstock comprising hydrogen and carbon monoxide, into a three-phase low temperature catalytic Fischer-Tropsch reaction stage which includes a slurry bed of a solid particulate shifting Fischer-Tropsch catalyst suspended in a carrier liquid;

allowing the hydrogen and carbon monoxide partially to react catalytically in the Fischer-Tropsch reaction stage to form hydrocarbons, at an overall CO and H_2 conversion of between 30 % and 60 %;

obtaining a tail gas from the Fischer-Tropsch reaction stage which includes unreacted hydrogen and carbon monoxide and also carbon dioxide;

adjusting the composition of at least a portion of the tail gas to provide a DME synthesis feedstock with a syngas number (SN) between 1.8 and 2.2, where

$$SN = \frac{[H_2] - [CO_2]}{[CO] + [CO_2]}$$

and where $[H_2]$, $[CO]$ and $[CO_2]$ respectively are the molar proportions of hydrogen, carbon monoxide and carbon dioxide in the DME synthesis feedstock;

feeding the DME synthesis feedstock into a DME synthesis stage; and

converting at least a portion of the DME synthesis feedstock fed to the DME synthesis stage to DME.

2. The process as claimed in claim 1, in which the syngas number is between 1.85 and 2.15.

3. The process as claimed in claim 1 or claim 2, in which adjusting the composition of at least a portion of the tail gas from the Fischer-Tropsch reaction stage includes removing some CO_2 from said portion of the tail gas, thereby adjusting the syngas number upwardly.

4. The process as claimed in claim 3, in which removing some CO_2 from said portion of the tail gas from the Fischer-Tropsch reaction stage includes absorbing the CO_2 in a solvent, and recovering the removed CO_2, by stripping the CO_2 from the solvent.

5. The process as claimed in claim 4, in which the CO_2 is stripped from the solvent with a methane-containing gas and in which the gaseous feedstock to the Fischer-Tropsch reaction stage is derived from the methane-containing gas.

6. The process as claimed in any one of the preceding claims, in which adjusting the composition of at least a portion of the tail gas from the Fischer-Tropsch reaction stage includes adding an H_2 rich gas to said portion of the tail gas.

7. The process as claimed in claim 6, in which adding an H_2 rich gas to said portion of the tail gas from the Fischer-Tropsch reaction stage includes reforming a portion of the gaseous feedstock to the Fischer-Tropsch reaction stage in a steam reforming stage to produce an H_2 rich reformed gas, and combining at least some of the H_2 rich reformed gas with said portion of the tail gas to provide the DME synthesis feedstock.

8. The process as claimed in claim 6, which includes removing an H_2 containing tail gas from the DME synthesis stage, recovering an H_2 rich gas from the DME synthesis stage tail gas, and adding said H_2 rich gas to the portion of the tail gas from the Fischer-Tropsch reaction stage to provide the DME synthesis feedstock.

9. The process as claimed in claim 6, in which adding an H_2 rich gas to said portion of the tail gas from the Fischer-Tropsch reaction stage includes subjecting a synthesis gas to the water gas shift reaction $CO + H_2O \rightleftharpoons CO_2 + H_2$, and removing at least some of the CO_2 to provide the H_2 rich gas, and combining at least some of the H_2 rich gas with said portion of the tail gas to provide the DME synthesis feedstock.

10. The process as claimed in any one of the preceding claims, in which some of the tail gas from the Fischer-Tropsch reaction stage is recycled to the Fischer-Tropsch reaction stage.

11. The process as claimed in any one of the preceding claims, which includes treating the hydrocarbons to provide a naphtha fraction and/or a kerosene fraction.

12. The process as claimed in any one of the preceding claims, in which the Fischer-Tropsch reaction stage is operated at a temperature of less than 280 °C so that the liquid hydrocarbon product from the Fischer-Tropsch reaction stage comprises predominantly wax.

13. The process as claimed in any one of the preceding claims, which includes withdrawing liquid hydrocarbon products and gases and vapours from the Fischer-Tropsch reaction stage and cooling the gases and vapours to condense liquid hydrocarbons and reaction water present therein and in which a kerosene fraction of the condensed liquid hydrocarbons from the Fischer-Tropsch reaction stage is treated to remove oxygenated hydrocarbons and then alkylated and subjected to a separation stage to produce linear alkyl benzene, and optionally paraffins and oxygenates.

14. The process as claimed in any one of the preceding claims, in which converting at least a portion of the DME synthesis feedstock fed to the DME synthesis stage to DME includes contacting the DME synthesis feedstock with catalyst or catalysts that enhance methanol synthesis and methanol dehydration reactions, thereby to produce DME.

15. A process for co-producing a liquid fuel and light olefins, the process including

co-producing liquid hydrocarbons and dimethyl ether (DME) from a gaseous feedstock comprising hydrogen and carbon monoxide, the liquid hydrocarbons and the DME being co-produced in accordance with the process as claimed in any one of claims 1 to 14 inclusive;

treating the liquid hydrocarbons to provide a liquid fuel; and

converting at least some of the DME into light olefins.

16. The process as claimed in claim 15, in which treating the liquid hydrocarbons to provide a liquid fuel includes subjecting at least a portion of the liquid hydrocarbons to

hydroprocessing, thereby to produce lubricants and a diesel fraction, the liquid fuel produced thus being Fischer-Tropsch derived liquid fuel and including a diesel fraction.

17. The process as claimed in claim 15 or claim 16, in which the liquid hydrocarbons are also treated to produce a naphtha fraction and optionally a kerosene fraction, and in which at least some of the naphtha fraction and optionally some of the kerosene fraction are converted with at least some of the DME into light olefins.